

WHAT IS CLAIMED AND DESIRED TO BE SECURED BY LETTERS
PATENT OF THE UNITED STATES IS:

1. A stand alone host controller, comprising:

5 a network interface;

a bus and at least one external port coupled to the bus;

and

a processor coupled to the bus and the network interface
and configured to process communications passed between the
10 network interface and the bus.

2. The host controller according the Claim 1, wherein the
bus is a Universal Serial Bus (USB), the external port is a USB
port, the communications are USB device related communications.

15 3. The host controller according the Claim 1, wherein the
network interface is at least one of an Ethernet port, a Wi-Fi
or other wireless connection, LAN connection, and an internal
interface to another system that provides network connection
20 services.

4. The host controller according to Claim 1, wherein:
the processor is further configured to implement USB 10.2
Host Controller requirements, receive USB formatted messages

from the bus, prepare USB related communications from the received USB formatted messages, and place the USB related communications on the network interface.

5 5. The host controller according to Claim 2, wherein:
the processor is configured to operate
an IP stack configured to work in conjunction with the communications being received and sent via the network interface,

10 a transaction server coupled to the IP stack and configured to process a set of messages passed to/from the IP stack and from/to the bus, and

a bus driver configured to facilitate transfer of the data and commands between the bus and the transaction server.

15 6. The host controller according to Claim 5, wherein the bus is a Universal Serial Bus (USB).

20 7. The stand alone USB host controller according to Claim 5, wherein the set of messages comprise at least one of Logon/Logoff, attach/detach, reset endpoint, and data transaction messages.

8. A method of operating a host computer, comprising the steps of:

identifying placement of a remote host controller on a network;

5 registering the remote host controller with the host computer; and

registering the host computer with the remote host controller.

10 9. The method according to Claim 8, wherein said step of identifying comprises receiving a broadcast message regarding placement of the remote host controller on the network.

15 10. The method according to Claim 8, wherein said step of identifying, comprises communicating with a well known port to receive information regarding placement of the remote host controller on the network.

20 11. The method according to Claim 8, wherein said step of registering the host controller comprises setting parameters within the host computer to trigger recognition and processing of messages received from the host controller.

12. The method according to Claim 8, wherein said step of registering the host computer comprises sending a registration request containing host computer identification information to the remote host controller.

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13. The method according to Claim 12, wherein said registration request includes security information to establish a trusted registration with the remote host controller.

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14. The method according to Claim 13, wherein said trusted registration is established by,

receiving an encoded password;

decoding the encoded password;

validating the decoded password; and

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responding to the host computer positively or negatively based on the validation.

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15. The method according to Claim 14, wherein said step of validating comprises comparing the decoded password to a list of valid passwords.

16. The method according to Claim 8, further comprising the steps of:

receiving a device message from the remote host controller with an identification of a device attached to the remote host controller; and

5 registering the device attached to the remote host controller with an operating system of the host computer.

17. The method according to Claim 16, wherein:

the method is embodied in a set of computer instructions stored on a computer readable media;

10 the computer instructions, when loaded into a computer, cause the computer to perform the steps of the method.

18. The method according to Claim 16, wherein the device is attached to the remote host controller via a Universal Serial
15 Bus (USB).

19. The method according to Claim 11, wherein said parameters include routing parameters for forwarding messages received by the host computer to a processing unit in the host
20 computer configured to process host controller related messages.

20. The method according to Claim 19, wherein said processing unit comprises a remote stand alone host controller driver installed in the host computer.

21. A method, comprising the steps of:

listening, with a host computer to a well known UDP port
for broadcast host controller identification messages;

5 retrieving a TCP port # and a sending IP address of the
remote host from a message broadcast from the well known UDP
port;

establishing a TCP session with the remote host using the
TCP port # and IP address.

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22. The method according to Claim 21, wherein the
broadcast host message comprises all the information needed to
set up a TCP session with the remote host controller.

15 23. The method according to Claim 22, wherein said
information comprises information needed to establish a
"connection" with at least one USB device attached to the remote
host controller.

20 24. The method according to Claim 21, wherein:
the remote host is a standalone host controller and the
sending IP address and TCP port # identify a transaction server
of the stand alone remote host controller.

25. The method according to Claim 24, wherein:

the stand alone host controller comprises a USB port; and

the stand alone host controller is configured to administer sharing of a USB device attached to the USB port with a plurality of host computers simultaneously coupled to the remote host via TCP session established with the TCP port # and sending IP address.

26. The method according to Claim 25, wherein the stand alone host controller is configured to issue a USB detach message only to host computers that attempt to communicate with a USB device if the USB device is already communicating with another remote host.

27. A method of operating a remote host device, comprising the steps of:

detecting connection of a network to the remote host device; and

broadcasting a message on the network identifying presence of the remote host including an identification of the remote host.

28. The method according to Claim 27, wherein said message identifying presence comprises security information for establishing a trusted connection.

5 29. The method according to Claim 28, wherein said security information comprises a coded password

30. The method according to Claim 27, further comprising the step of:

10 receiving a registration request from at least one host computer; and

 registering at least one of the host computers with the remote host.

15 31. The method according to Claim 30, further comprising the steps of:

 detecting presence of a peripheral device attached to the remote host;

 broadcasting an identification of the peripheral device to
20 the registered host computers;

 receiving at least one peripheral reply from the registered host computers; and

placing each registered host computer from which a peripheral reply is received on an access list for the peripheral device.

5 32. The method according to Claim 31, wherein said step of broadcasting an identification comprises broadcasting an identification of the peripheral device and a list of devices previously attached to the remote host device to the registered host computers.

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33. The method according to Claim 31, further comprising the steps of:

receiving an access request from an access list registered host computer; and

15 establishing a connection between the peripheral device and the requesting host computer.

34. The method according to Claim 33, further comprising the step of:

20 locking out other registered host computers from access to the peripheral devices for a duration of the connection.

35. The method according to Claim 33, wherein said step of establishing a connection comprises administering communications

between the requesting host computer and the attached peripheral.

36. The method according to Claim 34, wherein said step of
5 locking out other registered hosts comprises sending a detach message to the host computer if another host computer has communicated with the peripheral device within a predetermined time period of receipt of the communication request.

10 37. The method according to Claim 33, further comprising the step of coordinating communications between the host computer and the peripheral device.

15 38. The method according to Claim 37, wherein said step of coordinating communications comprises:

receiving a communication request from the host computer and placing the communication request on a USB bus attached to the peripheral device;

20 receiving communications from the peripheral device and placing them in a network formatted message and sending the network formatted message to the host computer; and

sending a detach message to the host computer if another host computer is communicating with the peripheral device at the time of receipt of the communication request.

39. The method according to Claim 27, wherein the remote host device is a network attached device configurable to administer communications between host computers coupled to the remote host device via a network and USB peripheral devices directly attached to the remote host device.

40. A method of operating a remote host, comprising the steps of:

detecting attachment of a peripheral device to the remote host; and

narrowcasting a message over a network to a predetermined set of host devices announcing the detection of the peripheral device.

41. The method according to Claim 40, further comprising the step of:

registering the attached peripheral device with at least one of the host devices in a manner such that the attached peripheral is accessible to applications running on the host device.

42. The method according to Claim 40, wherein:

said step of detecting comprises sensing attachment of the peripheral device and identifying the peripheral device; and

said step of broadcasting a message comprises broadcasting an identification of the peripheral device and an identification
5 of the remote host to the predetermined set of host devices.

43. The method according to Claim 42, wherein:

the method is embodied in a set of computer instructions stored on a computer readable media;

10 the computer instructions, when loaded into a computer, cause the computer to perform the steps of the method.

44. The method according to Claim 40, wherein the remote host is a USB stand alone host controller.

15 45. A stand alone host controller, comprising:

a network port;

at least one USB port; and

a transaction server, comprising,

20 a login thread configured to accept login requests received over the network port from a plurality of individual host computers, wherein the login thread verifies a password, and upon verification of the password, sends a login response to the

successfully logged in host computer that includes a list of all devices attached to the at least one USB port, and

an operational thread configured to process messages between a successfully logged in host computer and one of the attached devices selected by the logged in host computer.

46. The stand alone host controller according to Claim 45, wherein the attached devices are one of (1) under a default sharing model and (2) configured to a specific assignment to the IP address of the given client.

47. The stand alone host controller according to Claim 45, further comprising a sharing mechanism that allows more than one host computer to register for access to a single one of the attached devices.

48. The stand alone host controller according to Claim 47, further comprising a removal mechanism that prevents access by a host computer registered to access a specific attached device when the specific attached device is in use by another host computer also registered to access the specific attached device.

49. The stand alone host controller according to Claim 48, wherein the removal mechanism is configured to send a USB detach

message to a host computer that attempts to access an attached device when it is in use by another host computer.

50. A stand alone USB host controller, comprising:

5 at least one USB port;

a network port; and

a transaction server configured to register a device attached to the USB ports to a plurality of host computers coupled to the network port via a network;

10 wherein the transaction server comprises a conflicts mechanism configured to send a USB detach message to a host computer that attempts to communicate with an attached device when it is in use with another host computer.

15 51. The stand alone host controller according to Claim 50, wherein the transaction server maintains a device in use by a host computer when the host computer communicates with the device;

20 52. The stand alone host controller according to Claim 50, wherein the transaction server maintains a device in use by a host computer when the host computer communicates with the device and for a predetermined time period after any communications.

53. The stand alone host controller according to Claim 52, wherein the predetermined time period is approximately 3 seconds.

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54. The stand alone host controller according to Claim 50, wherein the transaction server is further configured to send a USB attach message to any host computers that attempted to communicate with an attached device while the attached device was in use by another host computer after the other host computer stops using the attached device.

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55. The stand alone host controller according to Claim 50, wherein the USB attach message is sent after a predetermined time-out period following non-use of the attached device by the other host computer.

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56. A computer readable media having a set of instruction stored thereon, that, when loaded into a processing device of a stand alone host controller, cause the stand alone host controller to perform the steps of:

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receiving USB messages packaged as a network message and received on a network port of the stand alone host controller; and

administering the USB messages to a selected USB device attached to the stand alone host controller.

57. The computer readable media according to Claim 56,
5 wherein:

the remote stand alone host controller is configured to share the USB device between a plurality of Host computers attached to the network; and

10 said steps include an arbitration step that only allows administering of USB messages from a single one of the plurality of Host computers in any given time frame.

58. A computer readable media having a set of instruction stored thereon, that, when loaded into a processing device of a stand alone host controller, cause the stand alone host
15 controller to perform the steps of:

registering a plurality of host computers;

sending a list of devices attached to the standalone host controller to each of the registered host computers; and

20 coordinating communications between each of the registered host computers and attached devices selected by the host computers.

59. The computer readable media according to Claim 58, wherein said instructions further cause the stand alone host controller to perform the steps of:

5 sending a detach message to a host computer that attempts to communicate with an attached device being used by another of the host computers.

60. The computer readable media according to Claim 58, wherein:

10 the host computers are coupled to the stand alone host controller via a network;

each of the attached devices are USB devices; and

said detach message is sent to the host computer if it attempts to communicate with an attached device in use or having
15 been in use by another of the host computers within a predetermined time period.

61. A method, comprising the steps of:

receiving data from a USB stack on a host computer for a
20 USB device logically installed on the host computer but physically installed on a remote stand alone host controller;

appending a header for the remote stand alone host controller onto the received data;

sending the received data and header to the remote stand alone host controller via a network.

62. The method according to Claim 61, wherein said step of
5 receiving occurs when the USB stack passes the data to a device driver for the remote stand alone host controller.

63. The method according to Claim 61, wherein said network
is an 802.11 network.

10 64. The method according to Claim 61, wherein said network is an Ethernet network.

65. The method according to Claim 61, wherein the remote
15 stand alone host controller is configured to share the USB device between a plurality of Host computers attached to the network.

20 66. The method according to Claim 61, wherein said method is embodied in a set of computer readable instructions, when loaded into a computer and used in combination with an application that sends the data to the USB device, cause the computer to perform the steps of said method.

67. A device driver, comprising:

a send data manager, comprising,

a capture mechanism configured to capture Application data associated with a USB device logically registered on a Host computer and physically located on a remote host controller,

a header mechanism configured to append a header identifying the USB device, and

a forwarding mechanism configured to forward the captured application data and appended header to a network stack.

68. The device driver according to Claim 67, further comprising a mapping device configured to maintain a map between a local USB protocol stack and device information exchanged with the remote host controller.

69. The device driver according to Claim 67, wherein said map comprises a USB bus address assigned by the NHCI and an address assigned by a local USB stack of the Host.

70. The device driver according to Claim 68, wherein said map comprises routing information utilized by the header mechanism to append a header that identifies the USB device.

71. The device driver according to Claim 67, wherein the device driver further comprises a receive data manager configured to receive data packages from an NHCI device and forward them to a local USB stack of the Host based on the map.

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72. The device driver according to Claim 67, wherein the remote host controller is configured to share the USB device between a plurality of Host computers attached to the network.

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73. A data package, comprising:

application data associated with a USB device logically registered on a Host computer but physically located on a remote host controller; and

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remote host controller header data prepended to the application data and identifying the USB device.

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74. The data package according to Claim 73, wherein said data package is constructed by a device driver using data received from a USB stack.

75. The data package, according to Claim 74, further comprising a device driver configured to send the data package over an attached network to the remote host controller.

76. The data package according to Claim 73, wherein the remote stand alone host controller is configured to share the USB device between a plurality of Host computers attached to the network.

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77. A data encapsulation scheme for use in a system for passing USB data from an application on a host computer to a USB device attached to a host controller coupled to the host computer via a network, the data encapsulation scheme comprising:

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a USB data packet to be delivered to a specific USB device;

a first set of header data attached to the USB data packet that identifies the specific USB device; and

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a second set of header data attached to the first set of header data that comprises network routing information corresponding to the host controller to which the specific USB device is attached.

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78. A computer readable media having a set of computer readable instructions stored thereon, that, when loaded into a computer, cause the computer to produce the data encapsulation scheme according to Claim 77.

79. The data encapsulation scheme according to Claim 77, wherein said first set of header data is produced via a device driver of the host computer hierarchically located between a USB stack and an IP stack of the host computer.

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80. The data encapsulation scheme according to Claim 77, wherein:

the host controller is configured to administer sharing of a plurality of attached USB devices between a plurality of host computers; and

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the sharing is in compliance with version 2.0 of the Universal Serial Bus (USB) Specification.